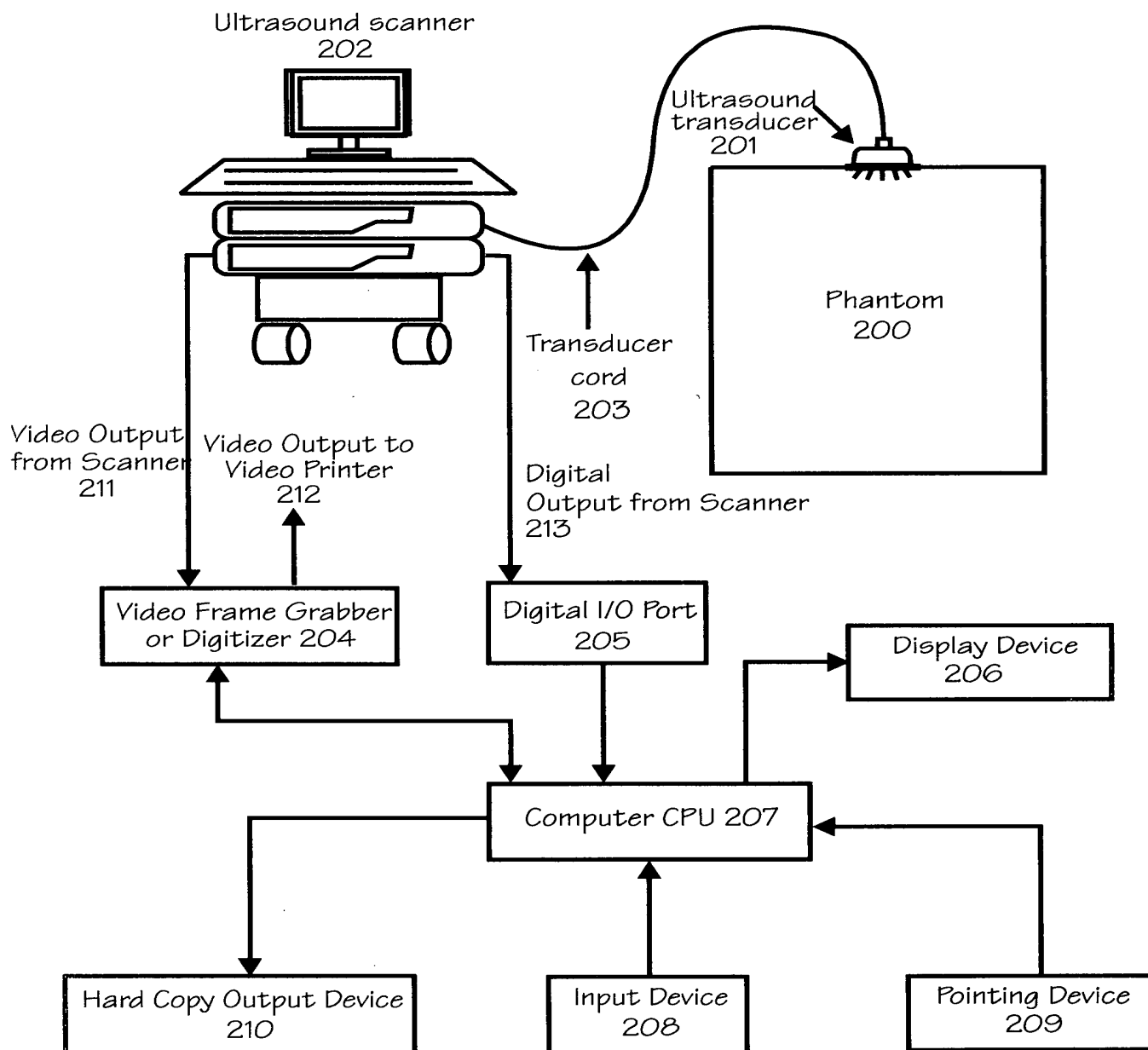


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Figure 1. Block Diagram of Typical Apparatus
for Evaluating Ultrasound Scanner



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Figure 2. Processing of "Phantom Image"

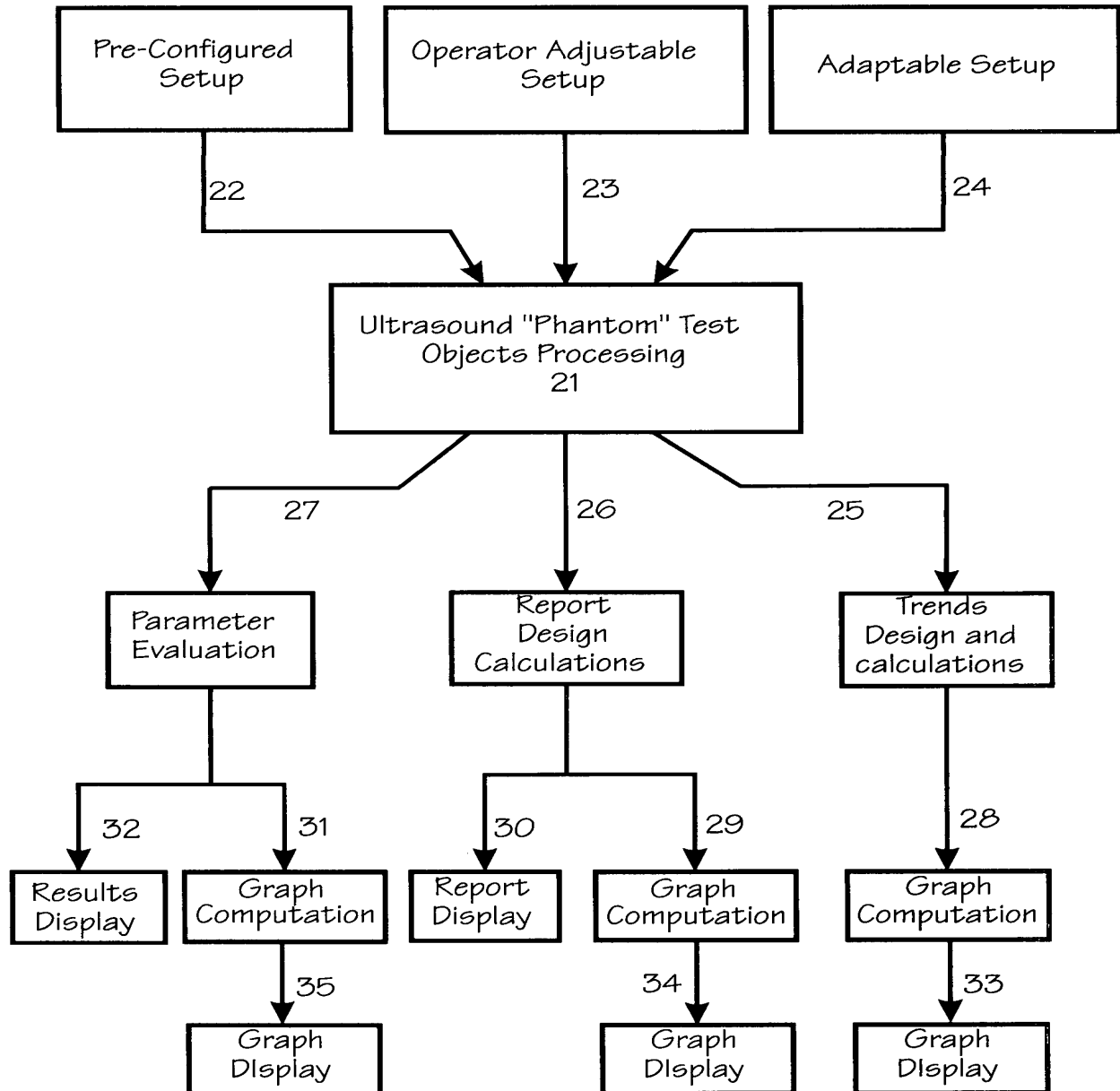
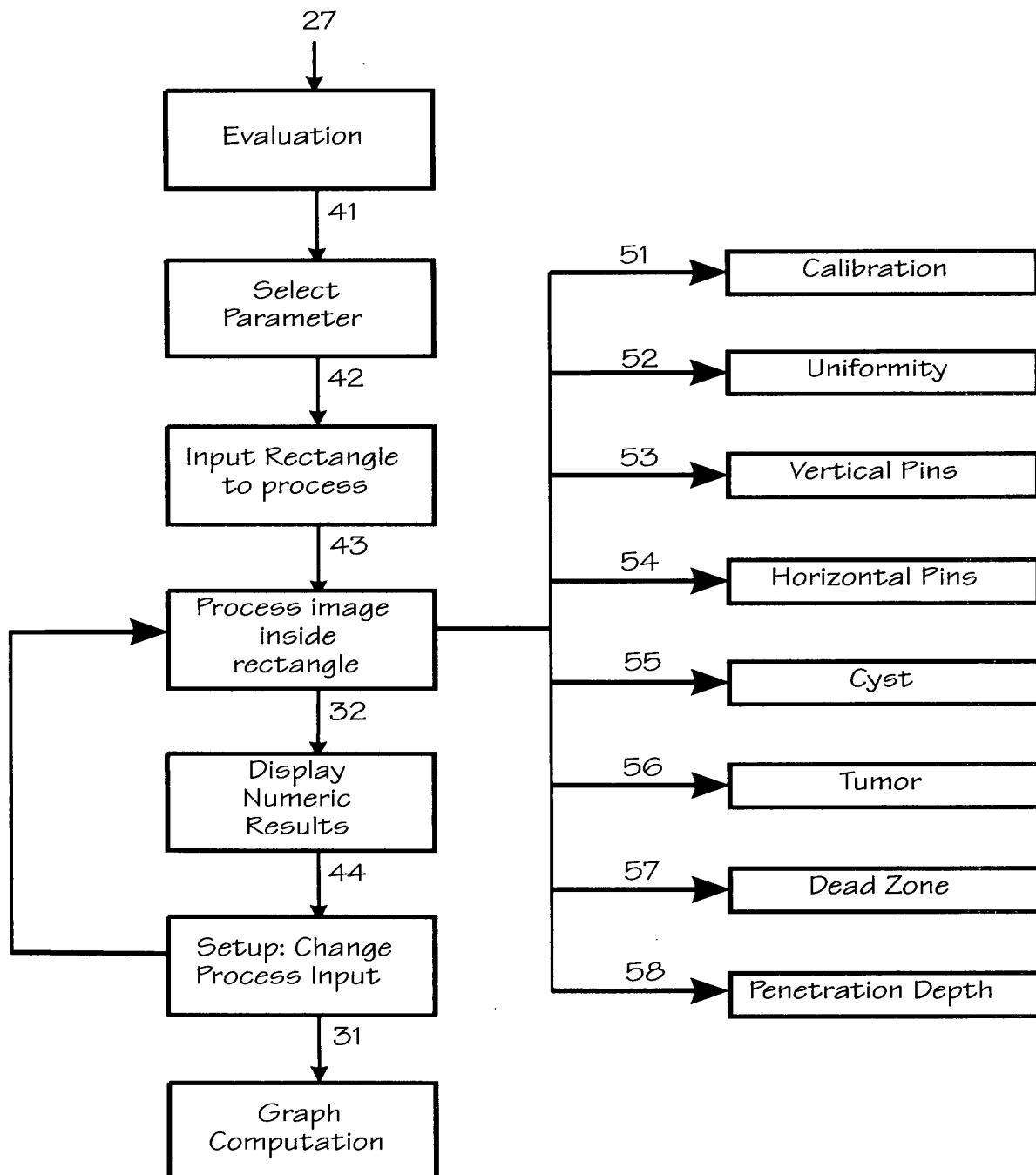


Figure 3. Parameter Evaluation Procedure



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Figure 4. General Schematic-Inputs

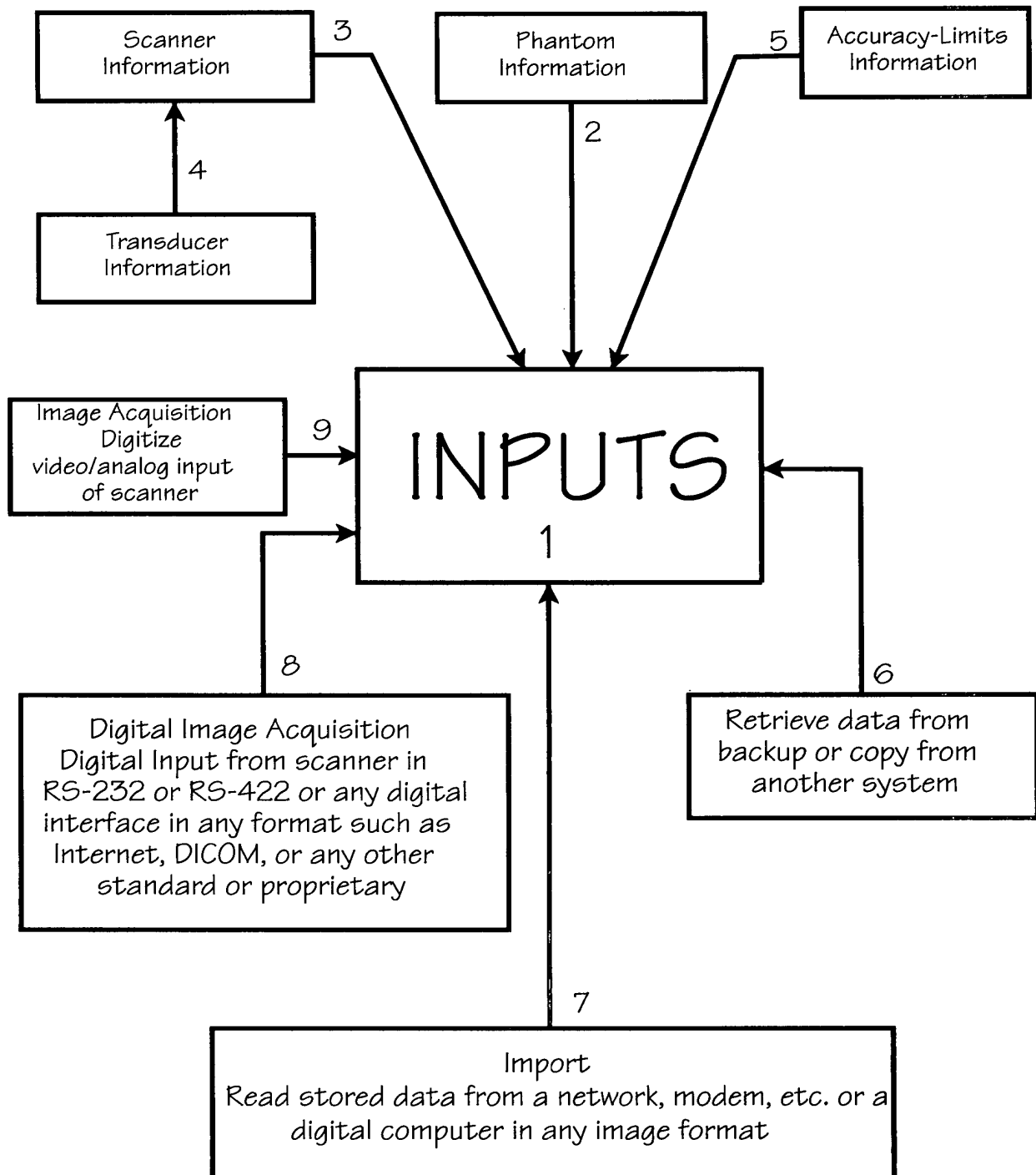


Figure 5. Phantom Test Objects

Phantom 200

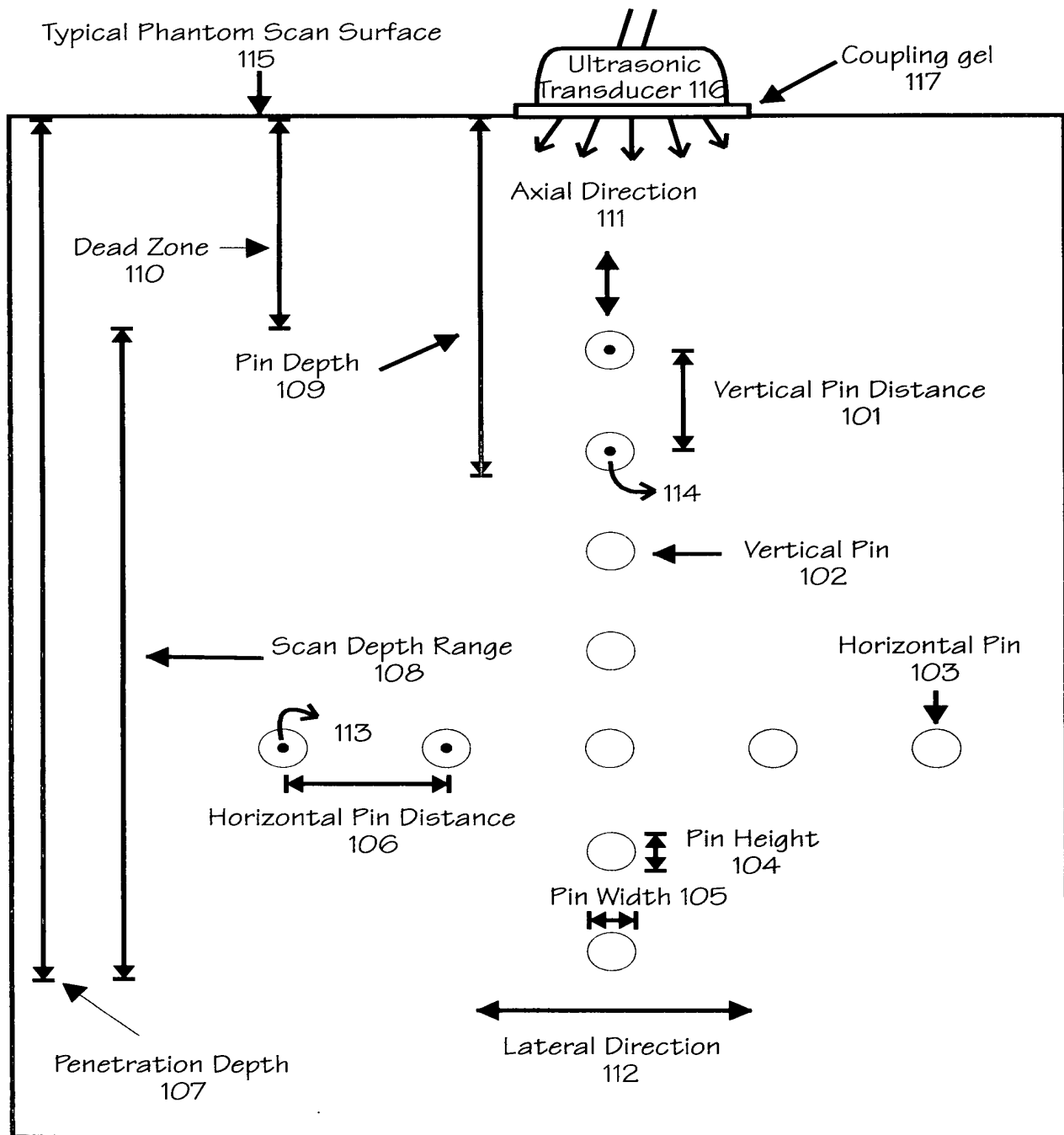


Figure 6. General Schematic-Outputs

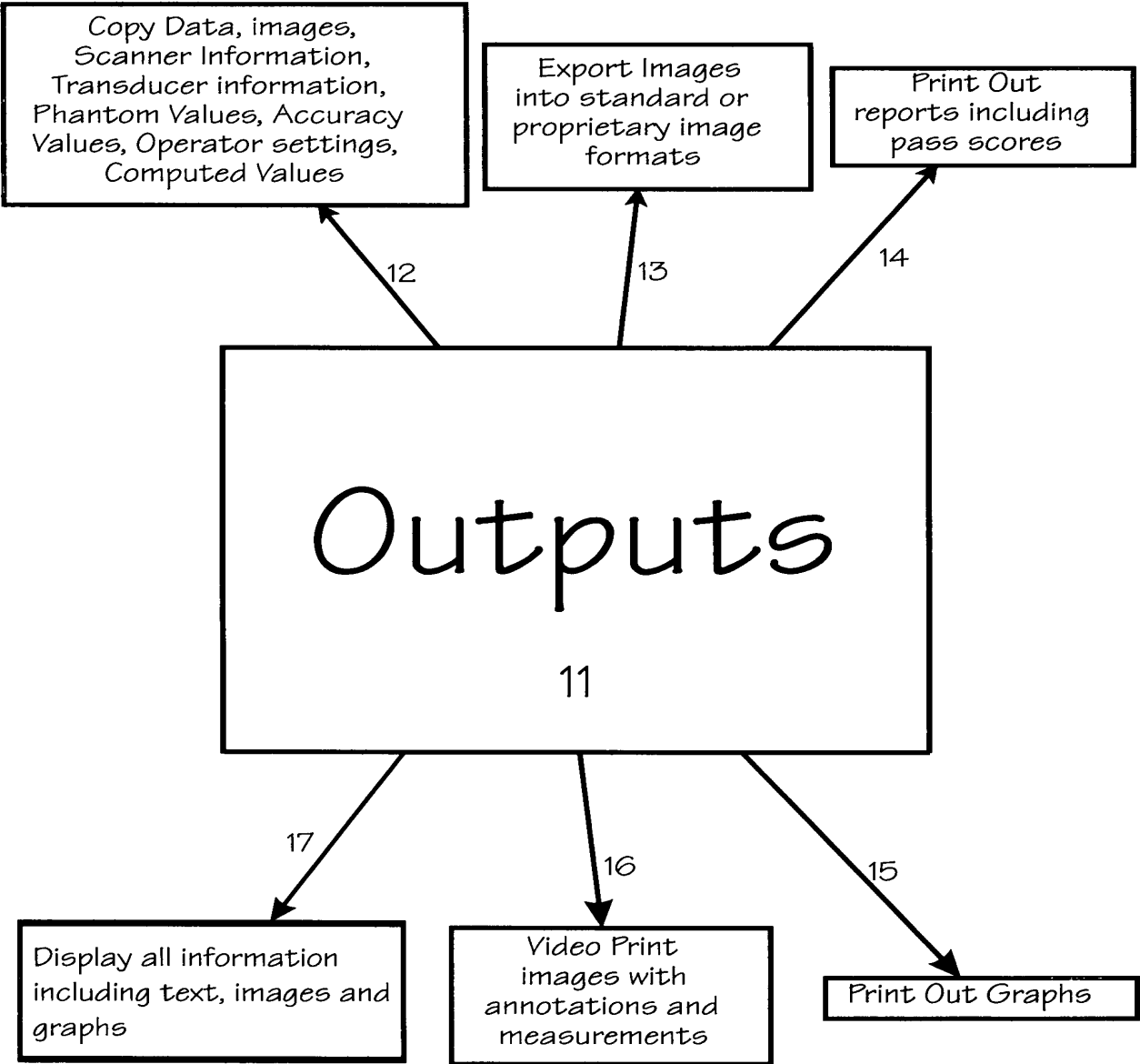
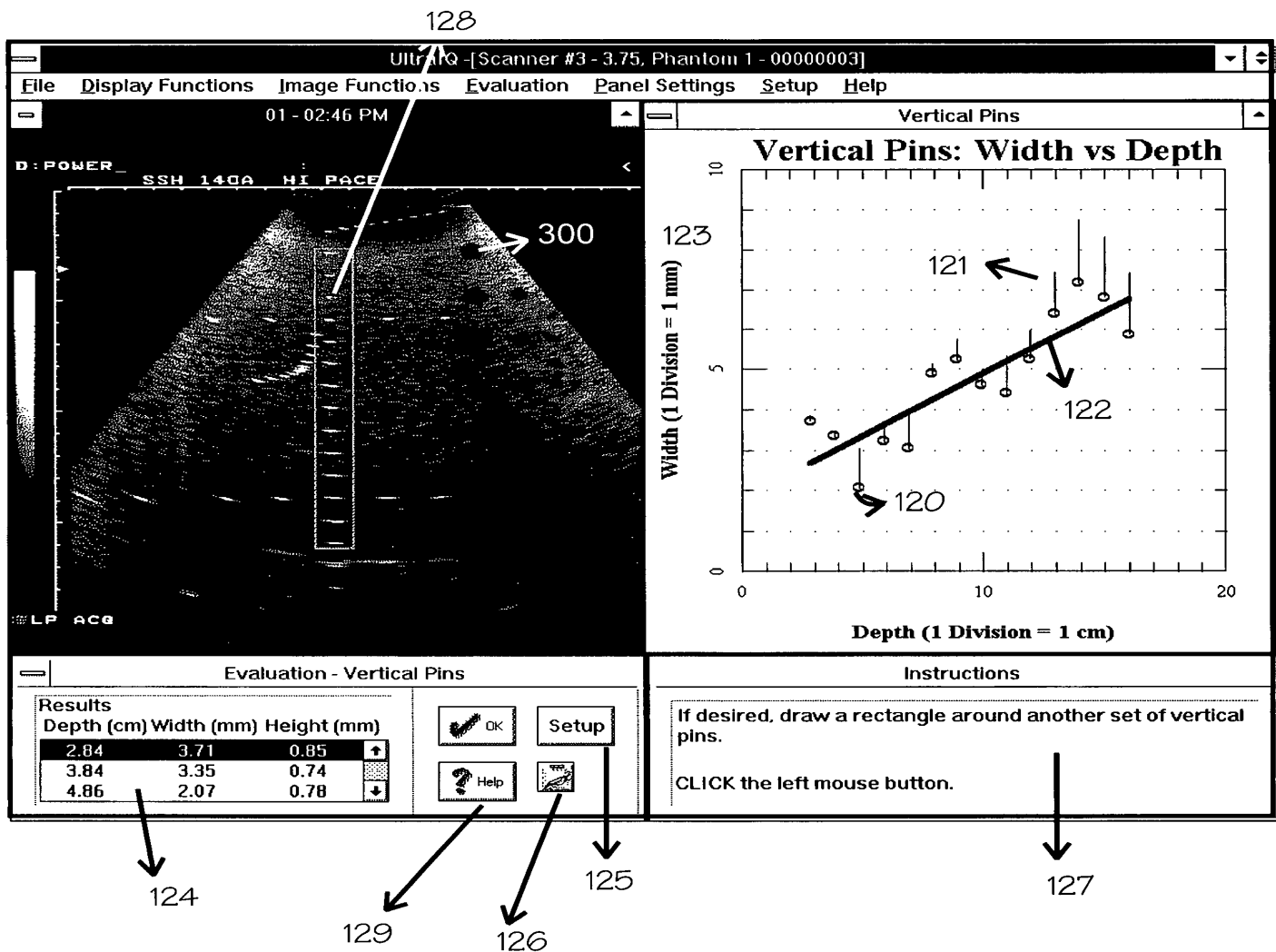


Figure 7: Display Example

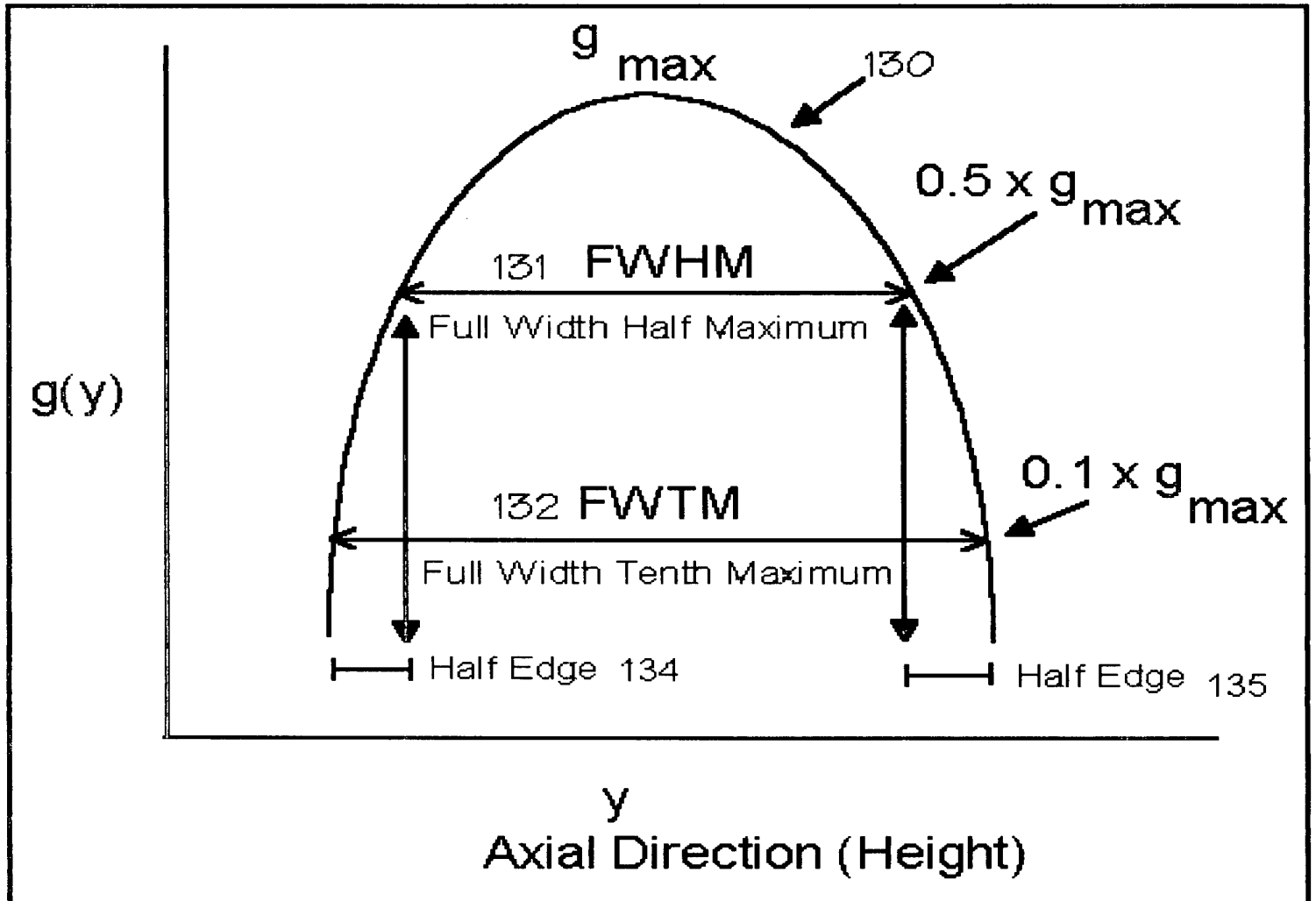
In Operation



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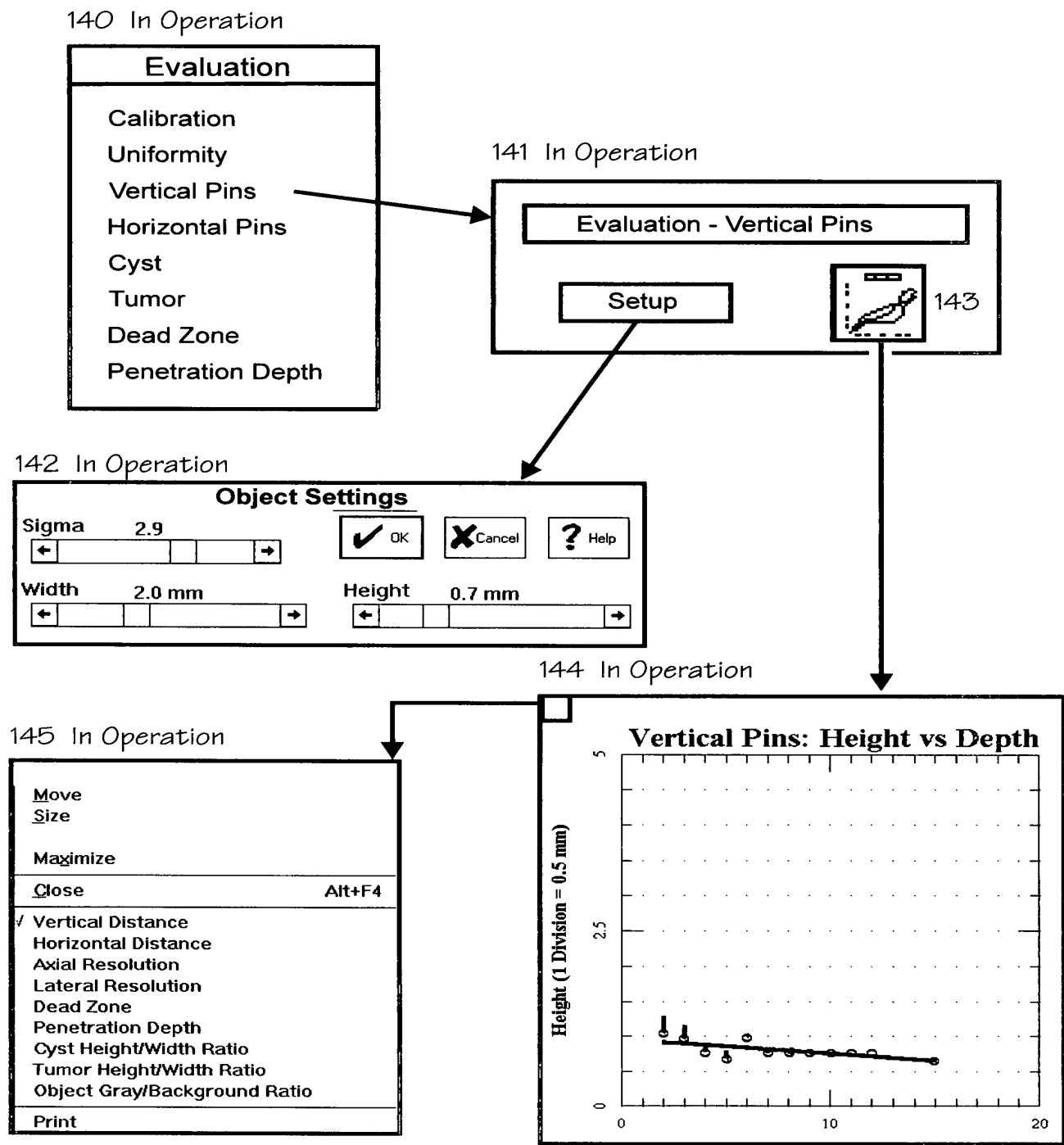
Figure 8. Example of Object Profile

Pin Object Gray Level Profile in Axial Direction



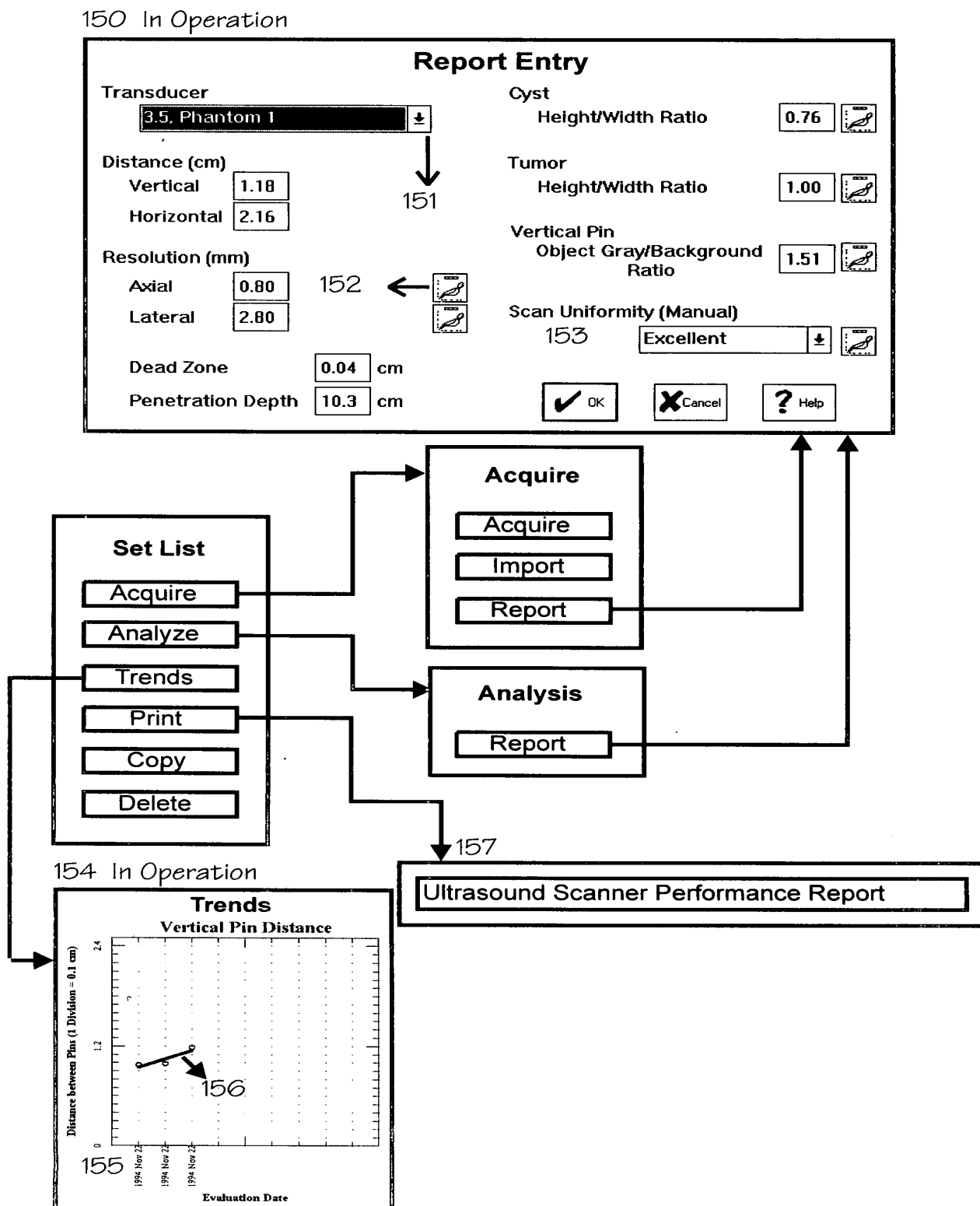
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Figure 9. Typical Evaluation Operational Flow Chart



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Figure 10. Typical Reports and Trends Operational Flow Chart



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Figure 11. Typical Processing Menus

160 In Operation

Display Functions	<u>I</u>n
<u>C</u>ontrast ...	C
<u>M</u>irror	▶
✓ <u>B</u>lack & White	B
<u>P</u>seudocolor	P
<u>I</u>nvrt	I
Red<u>u</u>draw Image ...	

161 In Operation

<u>C</u>ontrast ...
Mirror <u>H</u>orizontal
Mirror <u>V</u>ertical
<u>P</u>seudoColor
<u>W</u>indow Image
<u>I</u>nvrt
<u>M</u>aximize
<u>R</u>estore
<u>T</u>wo Image Panel
<u>V</u>ideo Print
<u>S</u>ave Parameters
<u>D</u>elete Image

163 In Operation

<u>T</u>rend	Trend
<u>R</u>estore	
<u>M</u>ove	
<u>S</u>ize	
<u>M</u>aximize	
<u>C</u>lose	Alt+F4
✓ <u>V</u>ertical Distance	
Horizontal Distance	
Axial Resolution	
Lateral Resolution	
Dead Zone	
Penetration Depth	
Cyst Height/Width Ratio	
Tumor Height/Width Ratio	
Object Gray/Background Ratio	
<u>P</u>rint	

162 In Operation

<u>E</u>valuation	
<u>C</u>alibration ...	F4
<u>U</u>niformity ...	F5
<u>V</u>ertical Pins ...	F6
<u>H</u>orizontal Pins ...	F7
<u>C</u>yst ...	F8
<u>T</u>umor ...	F9
<u>D</u>ead Zone ...	F11
<u>P</u>enetration Depth ...	F12

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Figure 12: Typical Dialog for Database Access -- In Operation

Scanner/Transducer List		
Scanner	Location	Transducer
Scanner #1	Mississauga	3.5, Phantom 1
Scanner #1	Mississauga	5.0, Phantom 1
Scanner #1	Mississauga	7.5, Phantom 1
Scanner #2	Etobicoke	3.5, Phantom 1
Scanner #3	Markham	3.75, Phantom 1
Scanner #3	Markham	7.5, Phantom 1
Scanner #4	Hamilton	2.5, Phantom 2
Scanner #4	Hamilton	3.75, Phantom 2
Scanner #5	Toronto	3.5, Phantom 2

☒ OK

Figure 13: Typical Dialog for Accessing Tasks -- Operation

Set List - Scanner #1		
Set Date	Set ID	
1994 Nov 22	00000001	<input checked="" type="checkbox"/> OK <input type="button" value="Acquire"/> <input type="button" value="Analyze"/> <input type="button" value="Trends"/> <input type="button" value="Print"/> <input type="button" value="Copy"/> <input type="button" value="Delete"/> <input type="button" value="Help"/>
1994 Nov 22	00000008	
1994 Nov 22	00000009	

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Figure 14. Typical Performance Parameters Entry Dialog In Operation

Phantom Values - Scanner # 1, 3.5, Phantom 1

Distance (cm)	Resolution (mm)	
Vertical <input type="text" value="1"/>	Axial <input type="text" value=".5"/>	Dead Zone <input type="text" value=".4"/> cm
Horizontal <input type="text" value="1"/>	Lateral <input type="text" value=".8"/>	Penetration Depth <input type="text" value="10"/> cm

Copy From

Scanner #1, 3.5, Phantom 1
↓

✓ OK

✗ Cancel

? Help

Figure 15. Typical Performance Parameter Limits Entry Dialog - In Operation

Accuracy Values - Scanner #1, 3.5, Phantom 1

Distance	Resolution	
Vertical ± <input type="text" value=".10"/> <input checked="" type="radio"/> mm <input type="radio"/> %	Axial + <input type="text" value="20"/> <input type="radio"/> mm <input checked="" type="radio"/> %	<div style="border: 1px solid black; padding: 5px; text-align: center;">✓ OK</div>
Horizontal ± <input type="text" value=".15"/> <input checked="" type="radio"/> mm <input type="radio"/> %	Lateral + <input type="text" value="20"/> <input type="radio"/> mm <input checked="" type="radio"/> %	
Dead Zone + <input type="text" value="3"/> <input checked="" type="radio"/> mm <input type="radio"/> %	Penetration Depth - <input type="text" value="5"/> <input type="radio"/> mm <input checked="" type="radio"/> %	<div style="border: 1px solid black; padding: 5px; text-align: center;">✗ Cancel</div>

Copy From

Scanner #1, 3.5, Phantom 1
↓

? Help

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Figure 16: Ultrasound Scanner Performance Report

Produced by	VIJAY RAMANATHAN			Date: 1995 Feb 20	
Measurements by	VIJAY RAMANATHAN			Date: 1994 Nov 22	
Scanner Name:	Scanner #3	Serial #	S3		
Manufacturer:	Company C	Model #	A3		
Location:	Toronto				
Transducer Name:	3.75, Phantom 1	Serial #	TRANS3.75		
Distance Accuracy:	Vertical Spacing	1.01 cm	Horizontal Spacing	2.12	cm
Spatial Resolution:	Axial	0.83 mm	Lateral	2.07	mm
Scan Depth:	Dead Zone	0.73 cm	Penetration Depth	16.5	cm
ObjectParameters:	Pin Object Mean Gray to Background Gray Ratio			2.27	
	Cyst Object Mean Height/Width Ratio			0.93	
	Tumor Object Mean Height/Width Ratio			0.75	
Scan Quality:	Uniformity/Artifacts			Excellent	
Transducer Name:	7.5, Phantom 1	Serial #	TRANS7.5		
Distance Accuracy:	Vertical Spacing	0.99 cm	Horizontal Spacing		
Spatial Resolution:	Axial	0.72 mm	Lateral	1.81	mm
Scan Depth:	Dead Zone	0.57 cm	Penetration Depth	7.6	cm
ObjectParameters:	Pin Object Mean Gray to Background Gray Ratio			18.90	

* - value to the left is outside acceptable range